REDUCING UNNECESSARY CARE

Estimating Environmental Impact

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1. The environmental implications of unnecessary care

The two cornerstones of sustainable healthcare are reducing activity and, where this is not possible, reducing the carbon intensity of activity. (1) Reducing activity by ensuring appropriateness of care is therefore a core component of environmentally sustainable healthcare.

The overuse of tests and treatments that offer little to no benefit to patients represents low-value health care. Such activity is not benign; it can "expose patients to potential harm, consume precious health care resources, and contribute to the climate crisis." (2) Indeed, insofar as each test and treatment comes at a carbon cost, finding ways to reduce their unnecessary implementation results in immediate environmental savings.

Choosing Wisely Canada, the national voice for reducing unnecessary tests and treatments in Canada, presents numerous recommendations regarding common tests and treatments that are not supported by evidence. These recommendations have been developed by professional societies representing different clinical specialties in Canada.

While providers are encouraged to consider any environmental benefits that may be associated with the recommendations specific to their specialty, the focus here is on low-value care that cuts across specialties, including preoperative visits and testing, and blood use. This document provides some background information on the sustainability opportunities in these areas, as well as environmental impact metrics that can be used to grasp the significance of interventions aimed at harnessing these opportunities.

1.1. Pre-op Tests and Visits

Many pre-surgical assessments and investigations are medically unnecessary because they do not provide useful information for perioperative patient care or outcomes; research on routine laboratory testing before low-risk surgery has shown that the majority of results are normal, and less than 3% of abnormal results lead to a change in management. (3)

These preoperative clinic visits and tests represent a form of low-value care insofar as they may contribute to healthcare inefficiencies and costs, and negatively impact patients due to harm from medical intervention and follow-up; the anxiety associated with receiving and waiting for test results; and time wasted. (4)

In addition to these issues, low-value tests and visits also contribute unnecessarily to the health sector's carbon footprint. (5) Testing produces emissions, primarily via energy intensive imaging and materials intensive bloodwork (6), while visits involve patient travel, with its associated carbon emissions. (7) Opting not to schedule low-value pre-op tests and visits will therefore reduce unnecessary environmental impacts associated with perioperative care. In one QI project focused on de-adopting low-value routine bloodwork for elective bariatric surgery, for example, 512 test tubes were saved from landfill, with an annual extrapolation of 946 test tubes saved (8).

If pre- and post-operative visits are deemed necessary, virtual appointments can help reduce their carbon intensity. (5) Similarly, some tests are less carbon intensive than others: there is evidence that MRI has the greatest environmental footprint, followed by CT, then US (9); the impact of echocardiography on human health, ecosystems, and resource use is 1–20% of other methods. (10) Thus, while "there are circumstances in which one imaging modality is preferred on clinical grounds, when everything else is equal," environmentally preferable tests can be selected. (10)

There also opportunities to reduce costs and environmental impact by reassessing the need for low value post-op bloodwork. A QI project at the Ottawa Hospital sought to de-adopt the low-value practice of routine post-operative day 1 laboratory testing following elective bariatric surgery. The extrapolated costs savings of the project for the hospital as a whole were CA$12,202.16 annually, with 946 test tubes kept out of landfills.(8)

1.2. Blood Use

Blood and blood products play an important role in perioperative care; red blood cell transfusions, for example, are administered to treat anemia and blood loss during surgery. (4,11) However, blood products are often overused in surgical (and other) settings: approximately 20% of all blood transfusions are unnecessary. (12) This overuse is not without consequence; beyond financial losses, transfusions contribute to increased risk of patient harm ranging from mild to life-threatening. (4,13)

In addition to the risks of overuse from inappropriate care, *underuse* also poses a problem insofar as failing to use blood products in a timely manner leads to wastage. There are many reasons for underuse, including expiration and failure to keep blood components at the required temperature. (14) The operating

room is a key site of blood product wastage; in a recent study, it was found to be responsible for significantly higher rates of wastage than other patient care areas, likely because of "excessive ordering of blood and blood products by a specific provider or providers in the perioperative setting." (14); indeed, massive over–ordering of blood has been demonstrated in both nonsurgical and surgical settings. (15)

Reducing blood wastage from both over and under use is important for patient outcomes and hospital budgets; it is also crucial given the scarcity of blood products in some contexts. (16) Yet there is another reason to properly manage blood products: the environmental costs associated with their use. Recent estimates of the carbon footprint of blood components in the National Health Service indicate that each blood product generates 6.5kg of CO_2 – this includes emissions attributable to blood donation and testing, and the manufacture, storage and distribution of blood components (emissions from laboratory testing, the transfusion process, and clinical waste disposal are not included in this figure as these are not yet known). (17) Given the number of transfusions in 2019 and the 20% rate of inappropriate transfusion, an estimated 3,000 tonnes of CO_2 emissions were needlessly produced that year. (17) This is the equivalent of providing electricity to 1820 homes for a full year. (18)

With the guidance and encouragement of surgical societies and initiatives like Choosing Wisely Canada, many sites in Canada have made great strides toward wiser blood use in and beyond the OR. (4,19) Recognizing the environmental co–benefits of wise blood use heightens the positive impacts of these efforts.

2. Estimating the environmental benefits of reductions in unnecessary perioperative care

Environmental data for various products and processes related to unnecessary care are presented below. While you will be able to generate reliable activity data related to unnecessary care, the limitations of available environmental impact data preclude using these two types of data in a calculation to generate an exact quantity of environmental savings. Thus, while environmental impact data have been pulled from the literature and presented below, these have limited applicability in estimates of environmental savings because:

a) Many of the figures are derived from non–Canadian sources. Various context–specific factors influence environmental impact (such as the energy mix of a given jurisdiction); as such, actual impact may be higher or lower elsewhere.
b) In producing environmental impact data, study boundaries must be drawn around a product or process based on what is feasible or known. Certain factors either upstream or downstream that would increase impact may not be included (i.e. emissions from the transfusion process are omitted from the emissions factor for blood products)
c) In some cases, emissions for actual products or processes are unavailable; instead, there are only averages for various products in the same category, or figures for similar items, or figures for components of products.
d) Certain assumptions have been made (such as scan length, use of contrast, operating mode, utilization rate, etc.) that may not reflect site–specific practices or averages

Given these caveats, the impact data and approaches provided below are therefore for informational purposes only. Modify as you see fit to suit your project(s), but be sure to report any environmental savings indicated from calculations like these as estimates only. Changes in activity data are often enough to show you are improving sustainability!

If you do present estimates of environmental savings arising from your interventions, it is advisable that you use equivalencies (such as km driven or homes powered) to demonstrate their significance using tools like the Natural Resources Canada GHG Equivalencies Calculator.

Note that these estimates can be made retroactively to indicate the environmental benefits that have arisen in concert with any successful efforts to reduce unnecessary care.

2.1. Pre–op Tests

Goal:

Reduce unnecessary investigations in pre–operative clinics in accordance with Choosing Wisely Canada recommendations to reduce the environmental impacts of care.

Metrics to consider:

<table>
<tr><th>Activity Data</th><th colspan="2">Environmental Data</th><th>Environmental Impact</th></tr>
<tr><td rowspan="6">Number of tests ordered</td><td>Baseline Laboratory Studies</td><td>CBC/Diff: 116g CO2e
INR/PTT: 82g CO2e

Source:
McAlister, 2020 (6)</td><td rowspan="6">Multiply activity data by environmental data for a given test over any period; over time, the resulting metric should decrease as unnecessary testing decreases, indicating carbon savings.

Notes:
• The calculation will yield ESTIMATES only
• Use the Natural Resources Canada Greenhouse Gas Equivalencies Calculator to translate your results to stakeholders.</td></tr>
<tr><td>Electrocardiogram</td><td>6.8 kg CO2e/ electrocardiogram patch

Source:
Ditac, et al. 2022 (20)</td></tr>
<tr><td>Chest x–ray</td><td>0.8 kg CO2e

Source:
McAlister, 2022 (21)</td></tr>
<tr><td>Echocardiography</td><td>0.5–2 kgCO2/ transthoracic echocardiography

Source:
Picano, 2023 (9)</td></tr>
<tr><td>Cardiac stress testing</td><td>Stress–US: 2–3 kg CO2 emissions/test

Stress–MRI: 200–300 kg CO2 emissions/study
Source: Braga, 2013 (22)</td></tr>
<tr><td colspan="2">Notes:
The above metrics have limited transferability as per the caveats listed in section 3, above.</td></tr>
</table>

Other metrics of interest:

Annual Environmental Impacts of Imaging Energy Consumption by Type (use–phase)

Imaging Type	Estimated Annual Energy Consumption (kW/h)	Estimated Annual Costs @ $0.15 kW/h (CAD)	Annual Equivalencies			
			CO2e Emissions in Pounds	Gallons of Gasoline Consumed	Pounds of Coal Burned	Miles in Average Passenger Vehicle
MRI (Siemens model)	190,687	$28,603	181,860	9,282	94,402	211,467
CT (Siemens model)	31,775	$4,766	30,304	1,547	15,397	35,238
X–Ray (Toshiba model)	2,811	$422	2,681	137	1,362	3,117

**Adapted from UofT Medicine Choosing Wisely Team: Project Green Healthcare (23). Equivalencies vary from original figures as they have been calculated using the most recent conversion factors in the EPA's Greenhouse Gas Equivalencies Calculator.*

2.2. Pre-op Visits

Goal:

Reduce unnecessary visits in pre-operative clinics in accordance with Choosing Wisely Canada recommendations to reduce the environmental impacts of care.

Metrics to consider:

Activity Data	Environmental Data	Environmental Impact
Number of visits (in person and virtual)	260g CO2e/km *km distance round trip to hospital Source: This figure is an average for the top 10 vehicles purchased in Canada in 2021(24) Notes: • There are many limitations involved in this calculation; these are outlined in the CASCADES Virtual Care Carbon Accounting Tool (VCCAT) as well as the accompanying VCCAT Playbook	Use the CASCADES Virtual Care Carbon Accounting Tool (VCCAT) to estimate the emissions associated with patient travel to your site during a given period (Consult the VCCAT Playbook for guidance). Over time, emissions should decrease as unnecessary visits are reduced, and/or as in person visits are replaced with virtual visits where appropriate. Notes: • The calculation will yield ESTIMATES only • Use the Natural Resources Canada Greenhouse Gas Equivalencies Calculator to translate your results to stakeholders.

2.3. Blood Use

Goal:

Reduce unnecessary red blood cell transfusion rate in accordance with Choosing Wisely Canada recommendations as blood transfusions have a significant environmental footprint.

Metrics to consider:

Activity Data	Environmental Data	Environmental Impact
Number of blood products used	6.5 kg CO2/blood product Source: Hibbs, et al. 2021 (17) Notes: • This figure has limited applicability as a) it is an average emissions factor for all blood products (the specific product you are considering may have higher or lower emissions); b) it is from a non-Canadian source, and; c) the figure excludes emissions from laboratory testing, the transfusion process, and clinical waste disposal as these are not yet known (the actual EF for blood products is therefore likely significantly higher)	Multiply these two data points for a given period; over time, the resulting metric should decrease as unnecessary blood use decreases, indicating carbon savings. Notes: • The calculation will yield ESTIMATES only • Use the Natural Resources Canada Greenhouse Gas Equivalencies Calculator to translate your results to stakeholders.

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